Remarks and Arguments

Claims 1-57 have been presented for examination. Claims 1, 3, 11, 15, 17, 25, 29, 31, 39, 43, 45, 53 and 57 have been amended.

Claims 11, 25, 39 and 53 have been rejected under 35 U.S.C. §112, second paragraph, as omitting the essential structural elements "the contents" of the recited "status-word fields", which when taken together, form a status word. In response, claims 11, 25, 39 and 53 have been amended to clarify the wording. Claim 11 is representative. As amended, it recites "...the contents of all of the status-word fields fit in a memory location accessible in a single machine instruction." It is believed that, as amended, claim 11 is now clear and concise and overcomes the rejection under 35 U.S.C. §112, second paragraph. Similar amendments have been made in claims 25, 39 and 53.

Claims 1-5, 7-9, 11-19, 21-23, 25-33, 35-37, 39-47, 49-51 and 53-57 have been rejected under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,434,590 B1 (Blelloch, previously cited) in view of U.S. Patent Publication No. 2001/0025295 (Kawachiya, previously cited.) The Blelloch and Kawachiya references and the examiner's application of these references to the claims have been discussed previously. In response, the independent claims have been amended to clearly recite that the actions of the threads themselves allow a collective decision to be made whether to terminate the performance of the parallel-execution operation.

For example, claim 1 recites, in lines 8-11, "i) each thread executes a task-finding routine to find tasks previously identified dynamically and performs tasks thereby found, ... until the task-finding routine finds no more tasks..." The examiner indicates that this step is disclosed in Blelloch at column 12, lines 3-15 and column 13, lines 47-65. These sections of Blelloch are part of a "THEORY" section of Blelloch that begins at column 9, line 14, and disclose a scheduling theory based on path tracing in directed acyclic graphs. This theory is used by a scheduler to schedule thread actions. The section to which the examiner refers at column 12, lines 3-15, discloses that successive thread actions are grouped into "tasks" in order to prevent the successive actions from being assigned to separate processors and thereby reducing the efficiency of the scheduling process. The section at column 13, lines 47-65 discloses that a thread is

broken into a new task when it is interrupted based on reads and writes of synchronization variables that are used by the threads to synchronize operations between themselves. However, Blelloch does not disclose that the threads themselves find and execute tasks as recited in step (i) of claim 1. Instead, Blelloch describes that a separate scheduler uses the graphs described at column 12, lines 3-15 and column 13, lines 47-65 to schedule the thread tasks. This separate scheduler is described at Blelloch at column 14, lines 4-11.

As discussed in the last office action, the Kawachiya reference discloses a technique for reducing the time required to access objects in memory, where the objects include a global locality flag that could be substituted for a task status buffer as disclosed in Blelloch. However, combining Kawachiya with Blelloch cannot teach or suggest that each thread should find and execute tasks as recited in step (i).

In step (ii), amended claim 1 recites "when the task-finding routine executed in step (i) finds no more tasks, that thread sets the contents of its associated status-word field to a value indicating it is inactive..." The examiner claims that this step is disclosed in Blelloch at column 5, lines 19-48, where it is recited that task queue and buffers manager BM1 updates status buffers. However, it is clear that the task queue and buffers manager is not the thread that executed a task finding routine as recited in lines 12-13 and performed found tasks as recited in lines 9-10. In addition, there is no indication that the task queue and buffers manager is the same as the aforementioned scheduler. Again, combining Kawachiya with Blelloch cannot teach or suggest that each thread should update the contents of its associated status-word field as recited in step (ii).

Amended claim 1 further recites in lines 15-20, "iii) after completing step (ii) and while the status-word field associated with any other thread contains a value indicating that the other thread is active, that thread continues to search for a task using the task-finding routine, and, if it finds one, sets its associated status-word field contents to a value indicating that it is active before attempting to execute a found task..." The examiner asserts that Blelloch discloses this step at column 5, lines 19-48. However, this section of Blelloch discloses that the task queue and buffers manager BM1 receives feedback from each thread and updates the status buffers, instead of the thread that

searches for new tasks and executes found tasks. Combining Kawachiya with Blelloch does not change this basic teaching of Blelloch.

Finally, amended claim 1 recites, in lines 21-24, "during step (iii) when none of the status-word fields associated with other threads contains a value indicating that an associated thread is active and no task has been found, that thread terminates its performance of the parallel-execution operation." The examiner claims that this step is disclosed in Blelloch, at column 5, lines 40-52. However, Blelloch discloses that the task queue and buffers manager BM1 examines the status buffers, determines whether the parallel program has been completed and informs each thread by placing an end of program marker in the task queue. This disclosure is contrary to the recitation in amended claim 1 that each thread examines the status-word fields and terminates based on its own examination. Kawachiya discloses nothing to the contrary. Thus, the combination of Blelloch and Kawachiya does not teach or suggest step (iv) recited in amended claim 1. Thus, amended claim 1 patentably distinguishes over the cited combination of Blelloch and Kawachiya.

Claims 2-5, 7-9 and 11-14 depend, either directly or indirectly on claim 1 and incorporate the limitations thereof. Consequently, they distinguish over the cited references in the same manner as claim 1. These claims also recite additional elements and limitations not disclosed in Blelloch as modified by Kawachiya. For example, claims 3, 5 and 7-9 recite that each thread has associated with it a respective work queue in which it places task identifiers of tasks that thread identifies dynamically and the task-finding routine executed by that thread includes performing an initial search for a task identifiers in the work queue associated with that thread and, if that work queue contains no task identifiers that thread can claim, thereafter performing a further search for a task identifier in at least one other task-storage location." In Blelloch/Kawachiya, a centralized task queue and buffers manager determines which tasks will be executed and updates the status buffers accordingly as disclosed in Blelloch column 5, lines 19-52, column 12, lines 3-15 and column 13, lines 47-65 as cited by the examiner and discussed above. Consequently, these claims also distinguish over the cited reference combination for this additional reason.

Claim 15 has been amended to contain limitations that parallel those in claim 1. Consequently, this claim distinguishes over the cited references in the same manner as claim 1. Claims 16-19, 21-23 and 25-28 depend, either directly or indirectly on claim 15 and incorporate the limitations thereof. Consequently, they distinguish over the cited references in the same manner as claim 15. In addition, these claims contain limitations that parallel those in claims 2-5, 7-9 and 11-14 and consequently, they distinguish over the cited references in the same manner as those latter claims.

Claim 29 has been amended to contain limitations that parallel those in claim 1. Consequently, this claim distinguishes over the cited references in the same manner as claim 1. Claims 30-33, 35-37 and 39-42 depend, either directly or indirectly on claim 29 and incorporate the limitations thereof. Consequently, they distinguish over the cited references in the same manner as claim 29. In addition, these claims contain limitations that parallel those in claims 2-5, 7-9 and 11-14 and consequently, they distinguish over the cited references in the same manner as those latter claims.

Claim 43 has also been amended to contain limitations that parallel those in claim 1. Consequently, this claim distinguishes over the cited references in the same manner as claim 1. Claims 44-47, 49-51 and 53-56 depend, either directly or indirectly on claim 43 and incorporate the limitations thereof. Consequently, they distinguish over the cited references in the same manner as claim 43. In addition, these claims contain limitations that parallel those in claims 2-5, 7-9 and 11-14 and consequently, they distinguish over the cited references in the same manner as those latter claims.

Claim 57 further has been amended to contain limitations that parallel those in claim 1. Consequently, this claim distinguishes over the cited references in the same manner as claim 1.

In light of the forgoing amendments and remarks, this application is now believed in condition for allowance and a notice of allowance is earnestly solicited. If the examiner has any further questions regarding this amendment, he is invited to call applicants' attorney at the number listed below. The examiner is hereby authorized to charge any fees or direct any payment under 37 C.F.R. §§1.17, 1.16 to Deposit Account number 02-3038.

Respectfully submitted

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